CLAIMS

What is claimed is:

1. A thin film resistor formed on a semiconductor substrate having a gate structure disposed thereover, said thin film resistor comprising:

a layer of dielectric material overlying said gate structure, said layer of dielectric material having an opening extending there through; and

a titanium oxynitride structure having a first portion that extends within said opening and directly overlies said gate structure, said titanium oxynitride structure having a second portion that overlies said layer of dielectric material, and said titanium oxynitride structure including a third portion that extends vertically between said first portion and said second portion.

2. A thin film resistor as recited in Claim 1 wherein said titanium oxynitride structure has high resistance stability, said high resistance stability obtained by performing a rapid thermal anneal in an oxygen environment.

3. A thin film resistor as recited in Claim 2 wherein said opening in said layer of dielectric material is rounded and wherein said third portion of said titanium oxynitride structure is cylindrical.

4. A thin film resistor as recited in Claim 2 wherein said titanium oxynitride structure has a resistance of from 100 to 10^6 Ohms/square with 100 Angstrom film.

5. A thin film resistor as recited in Claim 2 wherein said third portion of said titanium oxynitride structure extends along sidewalls of said opening in said first layer of dielectric so as to partially fill said opening in said layer of dielectric material.

6. A thin film resistor as recited in Claim 5 further comprising a dielectric plug, said dielectric plug filling a remaining portion of said opening in said layer of dielectric material.

7. A thin film resistor as recited in Claim 7 wherein said gate structure includes a conductive layer, said first portion of said titanium oxynitride structure directly overlying said conductive layer such that said conductive layer is electrically coupled to said first portion of said titanium oxynitride structure.

8. A thin film resistor as recited in Claim 7 wherein at least one overlying layer of material is disposed over said conductive layer and is disposed under said first dielectric layer, said protective layer having an opening extending therethrough, portions of said titanium oxynitride structure extending through said opening in said at least one protective layer, said protected layer selected from the group consisting of silicon nitride and silicon oxynitride.

9. A method for forming a thin film resistor on a semiconductor substrate having a gate structure disposed thereover, said method comprising:

forming a first layer of dielectric material that overlies said gate structure;

forming an opening in said first layer of dielectric material, said opening extending through said first layer of dielectric material so as to expose a portion of said gate structure;

depositing a layer of titanium nitride using a chemical vapor deposition process;

performing a rapid thermal anneal in an oxygen environment so as to form a titanium oxynitride film; and

patterning said titanium oxynitride film so as to form a titanium oxynitride structure over said semiconductor substrate.

10. A method as recited in Claim 9 wherein said titanium oxynitride structure has a first portion that overlies said exposed portion of said gate structure and has a second portion that overlies a top surface of said first layer of dielectric material, said titanium oxynitride structure including a third portion that extends vertically between said first portion and said second portion.

11. A method as recited in Claim 10 wherein said opening in said first layer of dielectric material is rounded and wherein said third portion is cylindrical.

12. A method as recited in Claim 9 further comprising depositing a layer of silicon nitride over said gate structure, said layer of silicon nitride disposed between said gate structure and said first layer of dielectric material.

13. A method as recited in Claim 12 wherein said gate structure includes a conductive layer, said opening extending through said layer of silicon nitride so as to expose said conductive layer, said first portion of said titanium oxynitride structure directly overlying said conductive layer and electrically coupled to said conductive layer.

14. A method as recited in Claim 10 wherein said step of performing a rapid thermal anneal further comprises flowing oxygen gas and nitrogen gas into a rapid thermal anneal chamber while said substrate is heated to a temperature of from 400 to 500 degrees centigrade for a time of from ten to sixty seconds.

15. A method as recited in Claim 9 wherein said first portion and said second portion of said titanium oxynitride structure partially fill said opening in said dielectric layer, said method further comprising depositing and etching a second layer of dielectric material so as to form a dielectric plug that fills a remaining portion of said opening in said first layer of dielectric material.

16. A method as recited in Claim 15 wherein said patterning said titanium oxynitride film further comprises:

depositing a metal layer over said titanium oxynitride film;

forming a photoresist masking structure over said metal layer, said photoresist masking structure exposing portions of said metal layer; and

performing an etch process to simultaneously pattern said metal layer and said titanium oxynitride film.

17. A thin film resistor formed in accordance with the method of Claim 9.

18. A method for forming a thin film resistor on a semiconductor substrate having a gate structure disposed thereover, said method comprising:

forming a first layer of dielectric material that overlies said gate structure;

forming an opening in said first layer of dielectric material, said opening extending through said first layer of dielectric material so as to expose a portion of a conductive layer of said gate structure;

depositing a layer of titanium nitride using a chemical vapor deposition process, portions of said layer of titanium nitride extending within said opening so as to partially fill said opening;

performing a rapid thermal anneal in an oxygen environment so as to form a titanium oxynitride film;

depositing a second layer of dielectric material, said second layer of dielectric material overlying said titanium oxynitride film and filling a remaining portion of said opening;

etching a portion of said second layer of dielectric material so as to form a dielectric plug that fills said remaining portion of said opening; and

etching portions of said titanium oxynitride film so as to form a titanium oxynitride structure having a first portion that overlies said exposed portion of said conductive layer and having a second portion that overlies a top surface of said first layer of dielectric material and having a third portion that extends vertically between said first portion and said second portion.

19. A method as recited in Claim 18 wherein said etching portions of said titanium oxynitride film further comprises:

depositing a metal layer over said titanium oxynitride film;

forming a photoresist masking structure over said metal layer, said photoresist masking structure exposing portions of said metal layer; and

performing an etch process to simultaneously pattern said metal layer and said titanium oxynitride film.

20. A thin film resistor formed in accordance with the method of Claim 18.